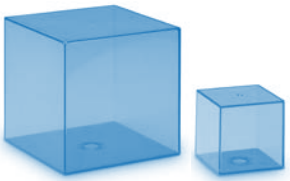
LEARNING RESOURCES®

LER 4331

Ages 8+ | Grades 3+

View-Thru® Geometric Solids

Activity Guide



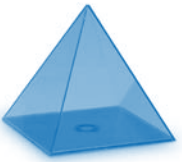
Cube

Sphere

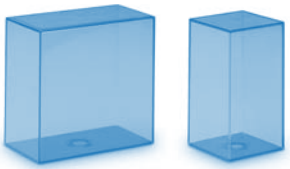
Cone

Cylinder

Hemisphere



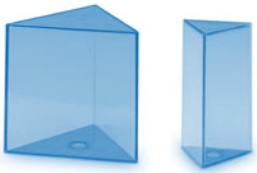
Square pyramid



Rectangular prism

Pentagonal prism

Triangular pyramid



Triangular prism

⚠ WARNING:
CHOKING HAZARD - Small parts.
Not for children under 3 years.

Volume Estimation

Introduce concepts of volume relationship between solid shapes with this set of 14 large View-Thru Geometric Solids. Use the shapes to estimate, measure and compare volumes in a small group or demonstration setting.

Have students list, from least to greatest, the estimated volume of each solid. Students should check estimates by calculating the volume or filling each shape with water using a graduated cylinder and recording the results beside each listed shape.

Volume Formulas

v – volume
l – length
s – side length of base
r – radius
w – width
b – base
h – height
a – apothem (length from the center of a polygon to one side)

Cube: $v = l^3$
Cone: $v = \frac{1}{3}(\pi r^2 h)$
Rectangular prism: $v = lwh$
Square pyramid: $v = \frac{1}{3}(lw)\,h$
Pentagonal prism: $v = \frac{5}{2}\,ash$
Sphere: $v = (\frac{4}{3})\,\pi r^3$
Cylinder: $v = \pi r^2 h$
Hemisphere: $v = (\frac{2}{3})\,\pi r^3$
Triangular pyramid: $v = \frac{1}{3}(\frac{1}{2}\,bh)\,h$
Triangular prism: $v = (\frac{1}{2}\,bh)\,h$

Terminology of Solid Geometry

base face of a geometric shape; bases of the View-Thru geometric solids are blue

cylinder two congruent, parallel circular bases and a single curved, lateral face

edge intersection of two faces of a polyhedron where they meet at a line

face polygon surface of a polyhedron; shapes in this set are either flat or curved

hemisphere one half of any sphere

polyhedron solid figure with a polygon face

prism polyhedron with two congruent, parallel bases and rectangles for the remaining faces; named for the shape of its bases

pyramid polyhedron with one base and triangles for the remaining faces; named for the shape of its bases

sphere the set of all points in space equidistant from a given point called the center

vertex intersection of three or more faces of a polyhedron where they meet at a point, or corner

Working with the View-Thru Geometric Solids to Measure Volume

The set of 14 View-Thru Geometric Solids is ideal for measuring and comparing volume relationships between the various solid shapes. In order to facilitate volume measurement relationships, set up the following materials at a geometry center or centers in your classroom:

Materials: View-Thru Geometric Solids
1000 Milliliters of plastic fill
Set of 2 funnels
Chart of the 14 solids and their characteristics
Paper and pencil/pen

Procedure: Have students estimate the volume of each of the 14 View-Thru Geometric Solids by listing them on a sheet of paper from largest volume to smallest volume.

Volume is expressed in cubic units of measurement: inches, feet, yards, miles, milliliters, centimeters, decimeters, meters, kilometers, etc.

Using the funnel, fill the 1-liter graduated cylinder with plastic fill.

Remove the base of the chosen solid and fill it with the plastic fill. Note the amount of fill required. Repeat two or three times to ensure accuracy.

Repeat the process with all of the shapes.

Have the students evaluate their data by listing the solids in descending order from most volume to least volume. Compare completed list with original estimation.

Discuss: What other materials could be used for the measurements?

What relationships exist between the various solids? How does the volume of the cube compare to the volume of the square pyramid? Explain any other comparisons derived from the data.

Characteristics of Geometric Solids

Work with the students to create a chart like the one below to record their own observations:

	View-Thru® Geometric Solids	Shape of Base(s)	Number of Faces	Number of Vertices	Number of Edges
1	Large Cube				
2	Small Cube				
3	Large Rectangle				
4	Small Rectangle				
5	Pentagonal Prism				
6	Large Triangular Prism				
7	Small Triangular Prism				
8	Square Pyramid				
9	Triangular Pyramid				
10	Large Cylinder				
11	Small Cylinder				
12	Cone				
13	Sphere				
14	Hemisphere				

Euler's Formula

Euler's Formula is named after Swiss mathematician Leonard Euler. In the mid-eighteenth century, Euler discovered that for any polyhedron, F + V = E + 2. In the formula, *F* represents the number of faces, *V* represents the number of vertex points, and *E* represents the number of edges. For example, a cube has 6 faces, 8 vertex points, and 12 edges.

F + V = E + 2

6 + 8 = 12 + 2

Have the students use their data from the preceding chart to discover Euler's Formula. Euler's Formula is true for the first nine solids listed in the table.

Intervention Strategies

Scaffolded Instruction: Before providing formulas to students, instead provide the definitions of perimeter and area, and opportunities to solve problems that allow students to gain data leading to the use of a formula. Begin with two-dimensional shapes before advancing to three-dimensional solids.

Directed Orientation: Use different household items that resemble a cube, cone, sphere, cylinder, pyramid, or prism. Have students sort the items by different attributes you provide. Then, introduce the formal shapes and have students match the shapes to the corresponding household items.

Free Exploration: Have students fill the solids with rice or water to explore properties of volume. Encourage students to make estimations and compare which shapes are able to hold more or less than the others.

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